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Research
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Designing Better Drop Inlets Page 4

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Sharing Progress

Agricultural research discoveries that benefit U.S. citizens are also being applied overseas to improve health, develop markets for U.S. goods, and build lasting friendships with other nations.

A top ARS entomologist is conducting a pilot study in Africa to evaluate chemosterilization as a means of controlling the tsetse fly. About 4½ million square miles of tropical Africa are infested by this fly that spreads sleeping sickness among humans and nagana among cattle, horses, sheep, and other livestock.

It is hoped that this sterilization technique can be as successful in Africa against the tsetse fly as radiation sterilization has been in the United States against the costly screwworm fly (AGR. RES., January 1964, p. 6).

Similar benefits growing out of ARS studies are numerous. Here are a few current examples:

A simple method of measuring protein quality (see page 3) could become a valuable tool in parts of the world where there is a shortage of high-quality protein for human diets . . . . . A powdered grapefruit juice is being evaluated by consumers in the United Kingdom and West Germany. Its acceptance could boost U.S. exports and provide more citrus in overseas diets . . . . . An expansion in U.S. exports of soybeans has resulted from an improved process for using U.S. beans to prepare two of Japan's most important foods—miso and tofu. This development coincides with a move by the Japanese government a few years ago to increase the use of soybean foods in that country by 40 percent in 10 years. U.S. exports of soybeans to Japan were up 16 percent in 1963 over 1960.

Among the most far-reaching aids to other nations is the technical assistance and training given by ARS scientists in conserving soil and water, in improving crops and livestock, and in controlling plant pests. The crop-destroying locust, for example, has been checked throughout its area of infestation in Africa, India, and the Middle East. This, in turn, is helping combat hunger, malnutrition, and poverty.

Contents

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Orville L. Freeman, Secretary
U.S. Department of Agriculture

B. T. Shaw, Administrator,
Agricultural Research Service

MEASURING PROTEIN QUALITY

Test for available lysine would aid quality control of mixed feeds, processed foods

■ ARS utilization scientists have developed a simple, routine method for determining the amount of available lysine, an essential amino acid of proteins, in cottonseed and other oilseed meals.

This new testing procedure will allow feed manufacturers to check the quality of oilseed meals, thus making more efficient use of these high-protein meals in mixed feeds for livestock, especially hogs and poultry. Present procedures for determining available lysine in oilseed meal are too complicated and expensive for routine use.

The new procedure, developed by S. R. Rao, V. L. Frampton, and F. L. Carter at the Southern utilization research laboratory, New Orleans, can also be used to determine available lysine in many protein-containing foods. It may prove valuable in many parts of the world, where increasing attention is being given to vegetable products—especially oilseed meals—as sources of high-quality protein in human diets.

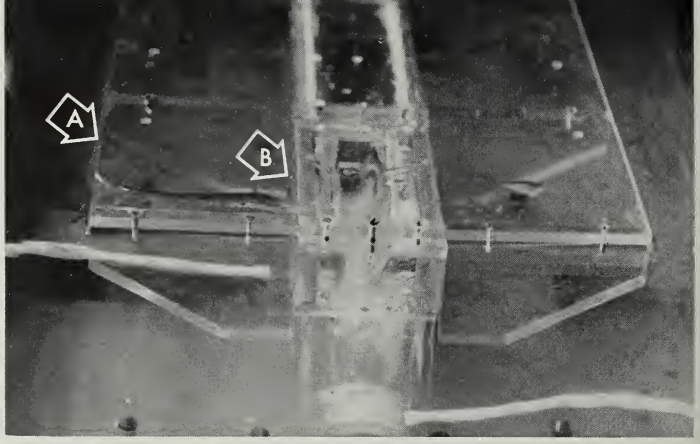
The amount of lysine that can be assimilated by the body—called available lysine—is fairly constant in any one kind of oilseed. When the seed is processed for oil, however, some of the lysine becomes chemically bound to other constituents and then cannot be assimilated. Thus, the meal left after oil is extracted contains less available lysine and has lower nutritive quality. For example, cottonseed protein contains about 4 percent available lysine. But after oil extraction, the available lysine content of commercial cottonseed meal ranges from 1.8 to 3.7 percent.

To determine the amount of available lysine in an oilseed meal with the new test, a half-gram sample is first treated with a series of chemicals. The sample is then examined with a spectrophotometer, which uses light of very precise wavelengths to indicate both the quantity and the quality of available lysine. The method lends itself to routine use, since one person can carry out eight different determinations simultaneously.

Oilseed meals constitute a large industry in the United States. In 1962, for example, the oilseed processing industry produced 2.7 million tons of cottonseed meal, valued at $178 million, and 11.1 million tons of soybean meal, valued at $788 million.☆

Designing better . . .

DROP INLETS



Water-management device would reduce construction cost of reservoirs, ponds, drainage systems

■ Close to 7,000 tests have gone into ARS research to make a widely used reservoir outlet structure more efficient.

To a layman, this structure looks like a box—with slots in the sides—perched atop a pipe through the dam that creates a reservoir. Engineers would call it a two-way drop inlet to a closed-conduit spillway.

Controls release of water

However described, the structure—consisting of a drop inlet and pipe—controls release of water from reservoirs and, as a secondary benefit, prevents damage to the area below the dam. And with design modifications being tested by ARS hydraulic engineers F. W. Blaisdell, C. A. Donnelly, and G. G. Hebaus, its use should reduce reservoir construction costs.

The research is cooperative with the Minnesota Agricultural Experiment Station and the St. Anthony Falls Hydraulic Laboratory of the University of Minnesota at Minneapolis.

Drop inlets and closed-conduit spillways are widely used by USDA's Soil Conservation Service on farm ponds and upstream flood-control reservoirs. Where these bodies of water are used for recreation, the structures help prevent extreme variation in the reservoir level. Similar installations are used on large reclamation reservoirs and flood-control reservoirs in the United States and other countries. They may also be used in highway drainage systems.

Blaisdell explains that the exit pipe from a reservoir usually flows only part full, unless the height of the drop inlet is equivalent to 5 times the pipe's diameter. In the past, engineers did not know that they were making incomplete use of the pipe capacity. And to improve efficiency, they would have had to install an oversize pipe or build a high dam that impounds water the necessary distance above the inlet.

But anti-vortex plates of just the right geometry, which act as a canopy over the inlet openings, will make the pipe carry more water than usual. The two-way drop inlet has canopies that are extensions of the closed top. These canopies change flow characteristics by controlling vortexes—the swirling of water often observed when draining a bathtub. During vortexes, air may replace as much as three-fourths of the water in the pipe.

The engineers are using small scale models to determine the structural proportions that are hydraulically superior. For example, the anti-vortex plate must be high enough above the crest of the drop inlet to admit ample water to seal off the pipe and make it flow full. But the plate must not leave such a wide opening that flow through the pipe is regulated by the reservoir's water level.

Ultimate ARS recommendations will be expressed in ratios of the various measurements to inlet width—not specific dimensions. These recommendations will apply equally well to drop inlets of all sizes.

For the tests of hydraulic efficiency, the scale models are connected to a water supply that can be varied in amount to simulate conditions encountered in typical field installations.

Design will reduce energy loss

In other tests, the engineers are developing design specifications that will minimize energy loss from friction at the drop inlet and pipe entrances. The energy saved adds velocity to water moving through the pipe, thus increasing the volume of

LEFT—Arrow A points to edge of canopy under which water flows toward slot opening, Arrow B, of drop inlet. This geometrical design keeps the air out of the water that enters drop inlet and pipe (see photo below).

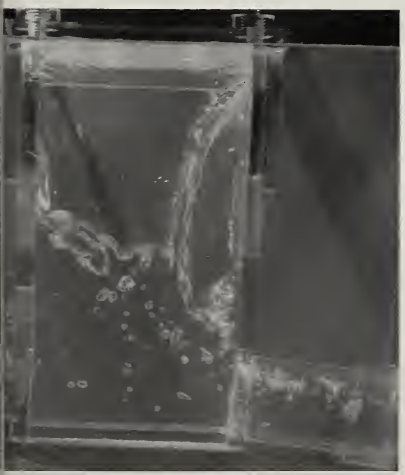
water flowing through the pipe.

In reporting results, the engineers subtract energy lost by friction along the sides of the models. Designers using the recommendations will add the friction factor characteristic of concrete, corrugated pipe, or other material to be used in the spillways they design.

For the energy-loss tests, the engineers use air instead of water, because previous research indicated that the flow of water and air through the models is hydraulically similar.

Air also substitutes for water in tests to determine pressure differences between many points on the outside and inside of the drop-inlet structure. Knowledge of the forces encountered will help designers provide structures that are strong enough to withstand the pressures encountered under operating conditions without damage.☆

This view shows another model of drop inlet. When in full operation, no air mixes with water that enters drop inlet.



New products score well in taste tests

FREEZE-DRIED FLAVOR

■ Consumer quality of 18 freeze-dried foods now on the market has been rated by a USDA taste panel as good or better than that of their canned or frozen counterparts. Ten other commercial freeze-dried foods were judged acceptable.

These ratings were made in consumer-oriented palatability studies conducted by ARS food scientists for USDA's Economic Research Service.

The taste-tested products were beef, pork, chicken, seafoods, soups, and mixed dishes—all prepared according to the manufacturers' instructions.

Taste-panel members rated the foods for general palatability and for five specific quality characteristics—appearance, flavor, juiciness, texture, and tenderness.

In the freeze-drying process, food is frozen and then dried in a vacuum, so that moisture is removed as vapor or gas—without going through the liquid stage. The weight of a freeze-dried product is as little as one-tenth that of the original food; it contains only 2 percent moisture and can be stored at room temperature.

Three foods prepared from freeze-dried products were rated better in eating quality than frozen or canned counterparts—beef noodle soup, chicken noodle soup, and shrimp creole. Fifteen freeze-dried foods were rated about equal to frozen or canned products. These were other soups, creamed chicken, ham, sausage, Swiss steak, and shellfish. Freeze-dried chicken and seafoods generally got higher scores when used in prepared dishes than when served plain.

The remaining 10 freeze-dried foods were rated poorer in eating quality than the frozen or canned products.

Relative standing of freeze-dried foods in the following categories was—

- Beef—in general, somewhat inferior.
- Chicken—slightly lower than those of the canned forms.
- Seafoods—about the same as the frozen products, the only low scores were for "fishy" flavors.
- Soups—as good as or better than the canned soup.
- Combination dishes—fairly good ratings except for peas, considered only fair in quality.

Details of the study are reported in an Economic Research Service publication, "Freeze-Dried Foods: Palatability Tests" (MRR No. 617). Single copies are available from the Division of Information, Office of Management Services, U.S. Department of Agriculture, Washington, D.C., 20250.☆

Land Forming for Drainage

Parallel-ditch method eliminates water barriers, equalizes soil moisture

■ Farmers in the Red River Valley of Minnesota and North Dakota are faced with the paradox of having waterlogged areas in fields at planting time but barely adequate precipitation for optimum crop production.

As a remedy, ARS and Minnesota Agricultural Experiment Station agricultural engineers recommend a type of drainage, called land forming, that changes field topography to allow orderly movement of water over the land.

Natural drainage is almost nonexistent in much of 3½ million acres in the Red River Valley, because the land is nearly as flat as a tabletop. Slopes of only 2 to 5 feet per mile are common, and the deep clay Fargo soils take up water slowly.

Water delays farm work

When the snow melts and the soil thaws in the spring, water accumulates in shallow field depressions. Water-filled low spots delay timely spring planting and prevent tillage after rains (see illustration, upper right). Farmers have installed outlet ditches at mile or half-mile intervals, but these ditches do not correct deficiencies in drainage *within* fields.

L. F. Hermsmeier of ARS and C. L. Larson of the Minnesota station found the parallel-ditch system of land forming best suited to land used for high-value row crops. They tested this system for 5 years at two locations in Wilkin County, Minn., where potatoes and sugarbeets are grown.

Land forming distributed soil moisture uniformly over the field. Eliminating low-yielding wet areas—and more timely farming of the remainder of the field—increased average productivity.

The engineers used a wheeled scraper drawn by a crawler tractor to construct the widely spaced field ditches, which were positioned at right angles to field slope and emptied into the outlet ditches. Then, with a 40-foot land plane, they graded the land between field ditches to uniform slope. Control plots were not ditched or leveled.

Crop rows were planted at right angles to the field ditches, which were shallow enough to permit passage of farm implements.

The engineers say that a minimum slope of 2 inches per 100 feet between field ditches is essential for proper maintenance. Grades above this minimum that prevent ponding of water without scouring of the soil during runoff should perform satisfactorily.

Grade length can vary

The length of the grade between ditches is largely determined by the cost of earthmoving and the ease of farming. Slope length did not affect crop yields in the experiments.

At test sites where grading removed a foot of topsoil, yields decreased under usual fertilization practices. These areas produced above-average crop yields, however, when they received 50 pounds of nitrogen and 40 pounds of phosphate per acre. Passage of heavy machinery during grading temporarily increased soil compaction.

Hermsmeier says land-formed fields need periodic attention—mostly leveling—every 5 to 10 years.☆

Mechanized Date Harvest

Three-way system features tower, vibrator, bulk handling

■ Some 4 million pounds of California dates were mechanically harvested last year with experimental equipment developed by agricultural engineers of ARS and the California Agricultural Experiment Station, Davis.

G. K. Brown of ARS and R. M. Perkins of California are developing a system for harvesting dates by the bunch—instead of one at a time—and for handling the dates in bulk instead of 30-pound lots.

Here's how the system works: A tractor-pulled "date tower" is positioned between two rows of date palms. The double tower, with two men on each platform, is hydraulically raised as much as 45 feet to the dates, which hang in bunches.

The bunches are cut by hand, then transferred to the base of the tower as it is being lowered and moved to the next pair of palms.

While the four tower men are elevated to resume harvesting, a worker uses a mechanical vibrator mounted at the base of the tower to shake the dates from the bunches into bulk bins that hold 1,000 pounds of fruit. Tests made by USDA's Agricultural Marketing Service indicate that dates can be handled for short periods in bulk depths of 18 inches or more without damage.

An experienced hand picker can harvest 150 pounds of dates an hour. With mechanization, one man can harvest nearly 1,000 pounds in the same length of time. The engineers estimate that mechanization cuts harvesting costs nearly in half—from about 1 cent a pound to about half a cent.

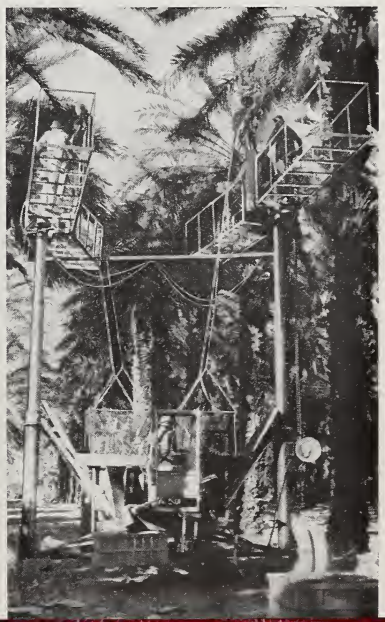
In the bulk system, dates are moved to the packinghouse with a minimum of labor and handling. The bulk bins are filled as the dates are harvested, placed on a truck by a fork-lift, taken to the packinghouse, and unloaded there with another fork-lift.

Hand harvesting requires handling many small boxes that hold only 30 pounds of fruit. The dates are gathered in buckets hanging from the picker's waist. When full, the buckets are lowered to the ground by rope, and the dates are placed in the boxes in shallow layers.☆

Bunches of dates are lowered in baskets hanging from catwalks.

In hand harvesting, worker is held in position by bosun's chair. Dates are gathered in buckets hanging from picker's waist.

Workers move on catwalks to harvest dates. Bulk bin is in foreground.



OPERATION COCKROACH

Way to prevent mating could come from discoveries revealing how mechanisms govern sex-attractant cycle

■ Surgery and the application of a tourniquet to a tiny nerve with a single silk fiber are among the assortment of skills and techniques used in ARS studies of how hormones affect a female American cockroach's production of sex attractant.

The research is part of an intensive effort by ARS scientists to learn details about insects and their habits—as a basis for developing more effective methods, especially biological methods, of insect control and eradication.

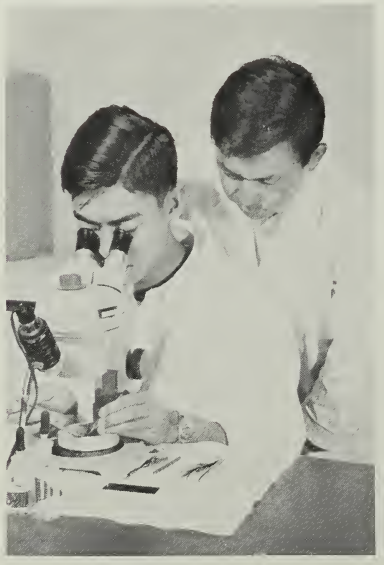
Adult female roaches normally start producing a sex attractant when they are 12 to 20 days old. Shortly after mating, attractant production stops and egg development begins. Learning *how* these related phenomena happen is the goal of basic studies by R. T. Yamamoto, entomologist in the ARS Pioneering Research Laboratory in Insect Physiology, Beltsville, Md.

Although the research is far from complete, it is now possible to explain some of the complex relationships of the brain, central nervous system, endocrine system, reproductive organs, and mating that are involved in sex-attractant production and ovarian development.

In the first phase of his research, Yamamoto demonstrated that the corpora allata, a pair of endocrine glands near the brain, produce one or more hormones that control sex-attractant production.

Surgical removal of these glands (allatectomy) stopped production of the sex attractant. And implanting a fresh gland—usually in the abdomen—from another female cockroach made allatectomized females resume sex-attractant production even though they had not produced attractant for as long as 30 days.

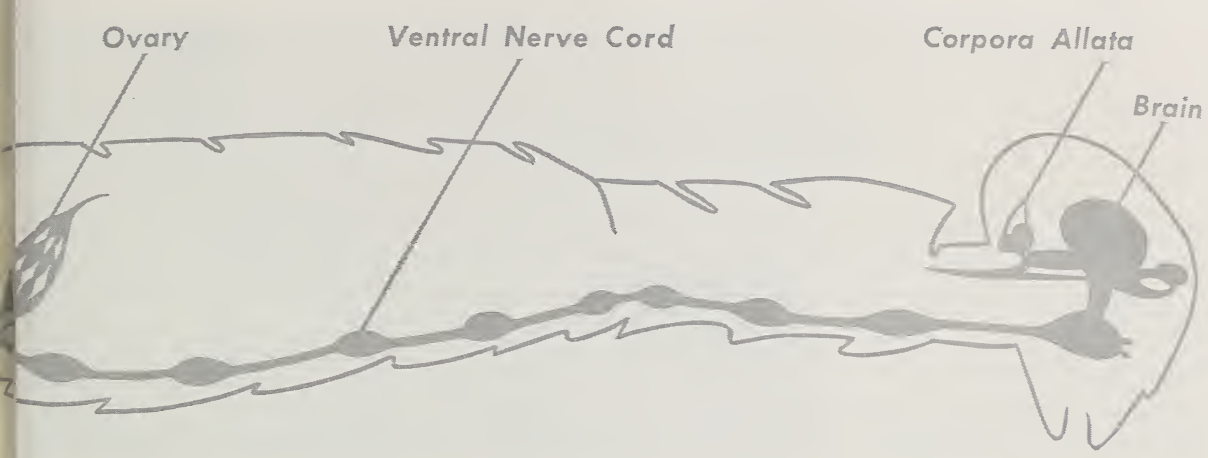
Yamamoto (standing) assists Chen in performing one of many delicate surgical operations.



Yamamoto further demonstrated that attractant production is under hormone control by injecting allatectomized females with an extract of juvenile hormone. This hormone, which is secreted by the corpora allata, inhibits adult development in early stages of the life cycle. Injections with either natural or synthetic juvenile hormone started attractant production. This response proves that the juvenile hormone is involved in controlling attractant production, but findings so far have not proved that this is the *only* hormone involved.

In the second phase of the research, Yamamoto established how mating stops sex attractant production and starts ovarian development. The changeover is triggered at least partly mechanically and is controlled through the nervous system.

Severing the nerve that connects the brain and the corpora allata glands caused the cycle to change from attractant production to ovarian development. The reaction to this operation not only implicates the brain and the corpora allata in the cycle switch in the natural situation, but also provides evidence that the switch is controlled through the central nervous



system. Findings thus far indicate that the following sequence takes place in the switch from one cycle to another:

In the mated female, an impulse travels through the central nervous system to the brain. The brain then removes an inhibition it has exerted—either through a nervous impulse or a secretion—over the corpora allata. The glands then produce a hormone that initiates egg development—but does not stop sex-attractant production. Stoppage of the attractant production involves a second hormone, which is thought to be secreted by the brain.

To obtain evidence on the brain's role in this sequence, Yamamoto and an assistant, D. H. Chen, performed one of the most delicate operations in the entire series of experiments—tying off the connecting nerve with a single silk fiber.

Yamamoto hopes to get some important information from the tying-off operation. For example, he wants to pin down whether the nerve transmits a secretion or an impulse that in effect shuts off the attractant production.

If it transmits a secretion, then a purely speculative—but inevitable—question can be raised: Could this secretion be synthesized for use on native populations of insects to prevent mating and reproduction?☆

A single silk fiber is used to tie off the tiny nerve that connects the brain and the corpora allata glands.

Pettibone takes data from CO_2 control unit.

Engineers develop equipment to regulate forced feeding of carbon dioxide

FERTILIZING GREENHOUSE AIR

■ Many commercial growers of greenhouse vegetables and ornamentals are increasing plant yields by "fertilizing the air" in their greenhouses with carbon dioxide.

But growers usually have no way of measuring the amount of CO_2 being used, nor do they know exactly how much the plants need. So research by ARS and Washington State Agricultural Experiment Station scientists at Pullman is aimed at developing equipment for accurately measuring and controlling CO_2 in greenhouses.

In their research, ARS engineer C. A. Pettibone, Washington engineer W. E. Matson, and Washington horticulturist W. B. Ackley boosted the yields of several greenhouse-grown vegetables and ornamentals by increasing the CO_2 from 300 parts per million (normal air) to 900 and 1,800 ppm in two plastic air-supported greenhouses. A third greenhouse had no CO_2 added.

In the greenhouse with normal air, 105 carnations were cut in 2 months. During the same period, 181 and 200 carnations were cut in the greenhouses with air containing 900 and 1,800 ppm of CO_2, respectively.

Pettibone and Matson engineered a system to sample and record the CO_2 in each greenhouse and in the outside air. This system also controls the amount of CO_2 in the two greenhouses where the air is "fertilized."

To generate the CO_2, dry ice is placed in a converter that turns the solid ice into a high-pressure gas. Several commercial growers in the Northwest have indicated interest in using this method to increase the CO_2 in their greenhouses.

Pettibone says the cost of the CO_2 for increasing the concentration seems to be more than compensated for by the increase in plant yield.

The scientists are using plastic air-supported greenhouses because these are more economical to build than glass greenhouses, and grower interest in them is increasing. Results of the research should apply also to conventional glass greenhouses, they say.

Each plastic greenhouse measures 14 by 24 feet and is held up—much like a balloon—by air pressure from a ½-horsepower blower, which also recirculates the air.☆

Plastic air-supported greenhouses are used in research with carbon dioxide.

Soil fungi cause . . .

PESTICIDE BREAKDOWN

■ ARS research has demonstrated conclusively that soil micro-organisms can detoxify the herbicide simazine.

A team at Beltsville, Md., found that one of the universal soil fungi, *Aspergillus fumigatus*, was able to use the carbon in simazine as a nutrient. This metabolic activity caused the herbicide to degrade, or change chemically, into nontoxic products.

Several other soil micro-organisms—other fungi, bacteria, and actinomycetes organisms—also proved capable of degrading this pesticide.

This study, by microbiologist D. D. Kaufman, biochemist P. C. Kearney, and plant physiologist T. J. Sheets at the Agricultural Research Center, is part of an ARS effort, through research on the fate of pesticides in soil, to find ways of improving the efficiency of these compounds, especially ways that will prevent or minimize residues.

Scientists already knew that various herbicides (and other pesticides) break down in the soil at varying rates—but they knew very little about what causes the breakdown.

In the experiments, solutions containing simazine, inorganic salts, and distilled water were inoculated with spores of the fungus *A. fumigatus*. Sucrose also was put in some of the test solutions to stimulate growth of the fungi by giving them more carbon, essential for the development of all living organisms.

To keep track of the carbon atoms during the degradation, the scientists used the radioactive tracer technique. Simazine was specially prepared in two forms, both containing radioactive carbon (carbon-14). In one form, the carbon-14 position was in the ring of the molecule; in the other form, it was in the chain.

By measuring the amount of radioactivity left in the culture solutions at 24-hour intervals after inoculation with the fungus spores, the scientists were able to determine whether the fungi were using up the simazine's carbon and, if so, how efficient they were.

The tests show that the fungus degrades only the chain portion of the simazine molecule. The carbon in the chain was reduced by about 60 percent within 8 days when the fungus had sucrose as a supplementary carbon source. The rate of degradation was only slightly less, however, without the sucrose as a stimulant.

These results were confirmed when the scientists measured the amount of radioactive carbon dioxide gas given off from the test solutions. About 35 percent of the radioactive carbon in chain-labeled simazine was eventually given off as gas during metabolism.

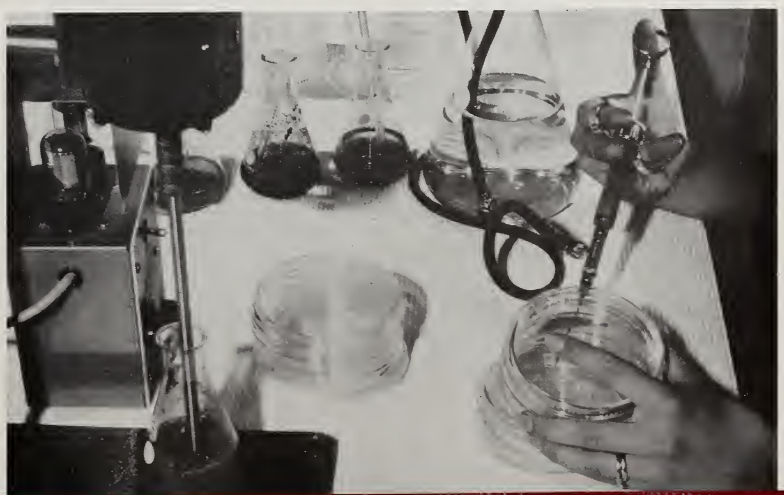
Greenhouse tests with oat plants also showed that the organism breaks down simazine. Oats are highly sensitive to this herbicide.

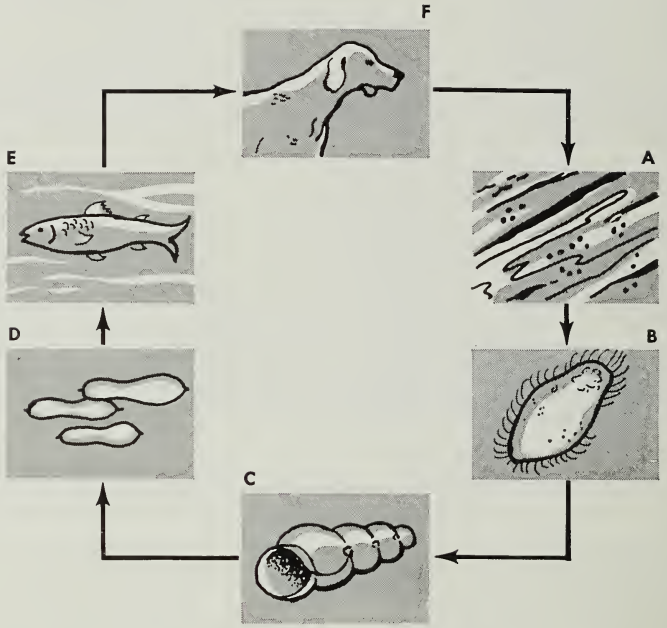
Solutions prepared as before—distilled water, plant nutrients, and simazine (both with and without spore inoculations)—were applied to test plants at 2-day intervals. All plants were killed when the solutions were first applied. Two days later, the solutions again killed all plants. After 4 days, plants receiving the solution containing the fungus did not die quite so quickly.

After 12 days (when 80 percent of the simazine in the inoculated solution had been degraded), plants receiving this solution survived—although growth was reduced about 20 percent below that of untreated test plants. The uninoculated solution killed the plants throughout these tests.

Further research is needed to identify chemically the products resulting from the breakdown.☆

Culture plates are prepared for inoculation with spores of universal soil fungus that detoxifies the herbicide simazine.





The disease organism hitchhikes in an intestinal fluke. Life cycle of fluke shows fluke eggs in stream (A), miracidium (B) that hatches from fluke eggs and enters snail (C). In snail, a miracidium becomes a redia, which produces numerous cercariae. After leaving snail, these larvae (D) enter fish (E) and become encysted. In dog (F) that eats infested raw fish, larvae become adult flukes, which lay eggs that pass from dog in feces and get into stream.

A FLUKE-CARRIED DISEASE

Research on canine infection in clarifying role of internal parasites in spreading disease

ARS veterinarian Farrell, heading the research, examines Oxytrema plicifer *snails—one host in fluke's life cycle.*

■ ARS scientists are studying a rickettsial disease of dogs, called salmon "poisoning" disease, to learn more about the role of internal parasites as vectors and reservoirs of virus and rickettsial infections.

Although the role of external parasites as vectors and reservoirs of disease in nature has been studied in great detail, the role of internal parasites is not well understood.

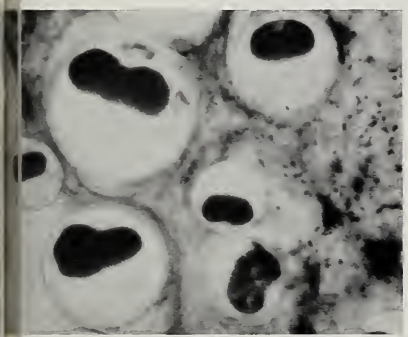
Salmon "poisoning" disease attacks dogs and other canines such as foxes that eat uncooked salmon or trout parasitized by the intestinal fluke *Nanophyetus salmincola.* This fluke carries the rickettsial micro-organism that causes the salmon "poisoning" disease. Untreated, the disease is usually fatal. But dogs that do recover are immune. For this reason—and because vaccines are not yet available—some owners deliberately infect their dogs to produce immunity, using antibiotics to cure the disease in its early stages.

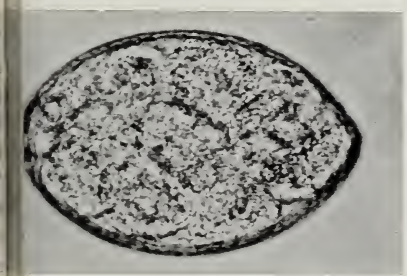
The studies on salmon "poisoning" disease are being done at USDA's Fur Animal Disease Research Laboratory, Pullman, Wash., in cooperation with Washington State University and the State's Game and Fisheries Departments. This research concerns the relationship of a fluke, a snail, a fish, warmblooded animals, and an infectious disease agent.

The fluke and infective rickettsial micro-organisms have been found in migrating salmon as long as 4 years after fish were experimentally infected. The fluke has been recovered from fish as far south as the Sacramento River of California; as far north as Bristol Bay, Alaska; and east of the Cascade Mountains in central Oregon and Washington.

RIGHT—A bear will not contract the disease, even if fish is infested with cysts of fluke larvae carrying the infection. But bears can harbor adult flukes and add to number of fluke eggs in streams.

BELOW (top to bottom)—Encysted fluke larvae in kidney tissue of a salmon; a fluke egg; adult and immature fresh-water snail Oxytrema plicifer.





The disease-carrying fluke requires two intermediate hosts to complete its life cycle—a fresh-water snail and a fish (see illustration). In streams, each fluke egg hatches into a miracidium, a free-swimming form that enters the snail *Oxytrema plicifer*. There the fluke passes through two more stages, emerging from the snail as larvae that penetrate the bodies of salmon and other fish of the same family. In this second host, the fluke larvae become enclosed in cysts in muscles and internal organs.

Of the animals that eat infested raw fish, only dogs and other canines contract salmon "poisoning" disease. In most animals, however, the fluke larvae develop into adult flukes. These flukes lay eggs, which leave the animal in feces and get into streams—ready to carry on the life cycle.

Present studies at Pullman indicate that the adult fluke can live in the intestines of raccoons for at least a year and perhaps equally long in bears and similar hosts. The adult fluke itself causes little damage to these animals—or the canines.

The disease-causing rickettsial micro-organism seems to be well adapted to the fluke's life cycle—it has been found in most of the flukes the scientists have recovered from snails, fish, raccoons and dogs. When and how the micro-organism gets into the fluke are among the questions now being studied.

The researchers also found that *rapid* buildup of fluke larvae in rainbow trout caused death for unknown reasons. *Slow* buildup led to massive fluke populations in the fish without mortality.☆

Sugar-Bowl Sorghums

New crop for Texas would expand domestic sugar supplies

■ Sweet sorghum has shown much promise as a new crop for the Lower Rio Grande Valley of Texas in trials by ARS and the Texas Agricultural Experiment Station. This potential new crop is now undergoing processing and marketing evaluations.

Sugar types are among the sorghums being tested. Expansion of U.S. sugar production has been underway since Cuba was cut off as a source of supply. On many Rio Grande Valley farms, sweet sorghum could supplement livestock production, which now ranks second to cotton for cash income. The climate is very favorable for growing sweet sorghum, and water for irrigation is readily available. About 700,000 of the Valley's 900,000 acres of fertile cropland are now irrigated.

Sugar, sirup, forage

In all, 15 sorghum varieties were grown at Weslaco in 1961 and 1962 and at San Benito in 1962—four high-sugar types; six experimental hybrids developed as sugar types at Meridian, Miss., by ARS and the Mississippi Agricultural Experiment Station; three sirup types; and two forage types. The tests were conducted by I. E. Stokes, ARS leader of sugarcane and sweet sorghum investigations; W. R. Cowley, superintendent of the Weslaco, Tex., substation; and J. N. Pratt, agronomist at the substation.

Good results were obtained in each group of sorghums, the investigating team reports. The best yield of sugar—obtained from Mer. 55–1, one of the experimental hybrids—was well above the U.S. average yield per ton of sugarcane (about 180 pounds). The hybrid's sugar yield per ton of stalks averaged 209.5 pounds the first season and 208.9 pounds the second season at Weslaco, and 239.4 pounds at San Benito. Per-acre sugar yields ranged from 2,795 pounds at Weslaco to 4,173 pounds at San Benito.

Mer. 55–1 is resistant to most sweet sorghum diseases and is well adapted to machine harvesting. It is expected to be released to growers soon.

Average yields for another hybrid, Mer. 57–1, were good, although somewhat below those of Mer. 55–1. Mer. 57–1 was grown only in 1962, and further testing is needed to evaluate this hybrid and the other four experimental hybrids, which had high yields of stalks but varied widely in sugar.

Good varieties are vulnerable

Two high-sugar commercial varieties did well. Brawley, an important variety in southern California, averaged nearly 178 pounds of sugar per ton of stalks during the two seasons at Weslaco and 236 pounds at San Benito. Similar yields were produced by Collier-MN 45, once an important variety in Kansas and other dryland areas. Both of these varieties, however, are susceptible to most sweet sorghum diseases.

Two sirup varieties, Tracy and Sart, from the Southeast, produced good stalk yields and are promising for sirup production.

Both forage varieties, Beef Builder T and Titan, produced excellent yields of stalks.☆

A shortcut to improved roses?

Breeding to improve some kinds of roses has always been difficult because of the long interval between pollination and flowering of the next generation.

Seedlings started in the late spring may not flower until spring or summer 2 years later, for example. Many of the roses that bloom in late spring or early summer are of this kind.

Recent ARS experiments suggest that the time lag between pollination and flowering can be reduced, thus helping to speed the improvement of roses to meet consumer demand. Horticulturist Peter Semeniuk, working at Beltsville, Md., has found that a combination of cold storage and forcing treatments can be used to initiate flower bud formation in some species.

Semeniuk's experiments demonstrated that *R. multiflora* and *R. setigera* (hedge types from which many common garden roses are derived) need a much longer period of cold before forming flower buds than horticulturists generally had realized.

Semeniuk held six groups of plants under various storage conditions for 20 weeks. He then subjected all of them to five different forcing regimes.

Only plants which had been cooled artificially at 40° F. and/or exposed in coldframes throughout the 20-week storage period (September through January) developed flowers following treatment, Semeniuk found. Even plants receiving a 20-week cooling treatment did not develop flowers when forced at 72° F. (night and day), the highest temperature used in the tests. Apparently, at a high forcing temperature, the final processes leading to flower initiation can be reversed or blocked.

To induce flowering, at least part of the second 10 weeks of cold storage is needed, Semeniuk says. The first 10 weeks were enough to break dormancy in lateral leaf buds on many plants but not enough to initiate flower buds.

One group that developed flowers after treatment had been held in a coldframe for 10 weeks, then kept in a room with controlled temperature (40 degrees F.) and given 8 hours daily of low-level incandescent light for the second 10 weeks.

These branches were cut from rose plants that received similar cooling treatments but different forcing regimes. Branch without flowers (right) failed to bloom when forced at highest temperature used in the tests.

Sows give parasite to unborn pigs

Research by ARS parasitologists at Tifton, Ga., shows that the intestinal threadworm, *Strongyloides ransomi*, can be transmitted prenatally from sow to pig.

This internal parasite is an important cause of death of suckling pigs, in which only a few threadworms can be fatal. Although it has been assumed that sows can transmit threadworms to their pigs prenatally, this is the first experimental evidence of the transmittal. The new data may be helpful in finding ways to prevent prenatal infestation and thus improve control of this pest.

The parasitologists fed 7 million threadworm larvae to a pregnant sow a week before she farrowed; then, after her litter of eight pigs was farrowed, they examined them for threadworms. Two of the pigs—one stillborn—were examined shortly after the sow farrowed. Threadworm larvae were in their lungs and livers but not in their intestines.

The remaining six pigs in the litter began passing threadworm eggs 2 to 4 days after birth—3 to 5 days sooner than pigs that become infested after birth.

Intestinal threadworms in hogs can

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cause diarrhea, poor appetite, and weight loss, resulting in unthriftiness or even death.

Minor threadworm infestations may have little noticeable effect on most adult hogs. Even a light case can cause death, however, if the young worms invade the heart muscle and damage its regulating mechanism.

Antibiotics aid weevil research

Entomologists at the Boll Weevil Research Laboratory, State College, Miss., report a new use for antibiotics—protecting boll weevils from disease during shipment. The weevils were given a combination of novobiocin and tetracycline.

Boll weevil diseases threatened to seriously curtail work at this ARS laboratory, which is operated in cooperation with the Mississippi Agricultural Experiment Station.

First, protozoan diseases hit the artificial rearing unit and made it impossible for the scientists to grow the large number of weevils needed for experiments. Local collection wasn't possible; the diseases hit during winter months, when there were no weevils in local fields.

As an alternative to artificial rearing, the scientists arranged to have boll weevils collected in Mexico and shipped in. Success of this plan was threatened also, when two bacterial diseases caused high mortality of the weevils during collection and shipping. Some shipments were wiped out by the infections, which were caused by a *Serratia* species and a *Pseudomonas* species.

Since it was not feasible to prevent contamination at the collection site, the entomologists decided to attempt disease control in the Mexican shipments by feeding antibiotics. They did not have time to screen antibiotics for those most effective, so they arbitrarily selected an antibiotic compound containing novobiocin and tetracycline—theorizing that two active ingredients would be more likely to succeed than one.

Deaths among boll weevils in the shipments decreased sharply after the antibiotic feeding was started. Scientists credit the treatments for permitting successful shipment of weevils over a long distance—and for preventing a serious lapse in the studies.

Animals spread fowl cholera

ARS studies at the National Animal Disease Laboratory, Ames, Iowa, emphasize the need for good sanitation for on-the-farm control of the organism that causes fowl cholera and related diseases.

The scientists say that allowing domestic livestock, pets, rodents, or other animals and birds to come in contact with dead or diseased poultry can infect neighboring or replacement flocks.

Almost every animal tested was susceptible to or a potential carrier of a highly virulent strain of the fowl cholera organism, *Pasteurella multocida*. Chickens, pigeons, sparrows, rats, mice, guinea pigs, mink, ferrets, sheep, calves, and pigs were used in these experiments by microbiologist K. L. Heddleston and biologist L. P. Watko.

All sparrows and most pigeons died that were given drinking water contaminated with the fowl cholera organism.

Pigeons, sparrows, rabbits, and mice died after the organism was put in their nostrils to expose them to the disease. But intranasal exposure caused no noticeable response in rats, ferrets, guinea pigs, a sheep, a pig, and a calf. The organism was isolated, however, from the nasal passages of the calf and the pig 34 days after exposure and was found to be highly virulent in tests with chickens. The calf and the pig thus were established as potential carriers of the disease.

Rats also proved potential carriers. When several were fed contaminated chicken liver, one developed nasal congestion, and the fowl cholera organism was isolated from its nasal passages 11 days later.

Mink developed pneumonia when fed meat of chickens that had died of cholera. But ferrets had no reaction to either diseased meat or injections of the fowl cholera organism.

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